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ABSTRACT

Notecards is a computer environment designed to help people work with ideas by providing a set of tools for a variety of specific activities, which can range from sketching on the back of an envelope to formally representing knowledge. The basic framework of this hypermedia system is a semantic network of electronic notecards connected by arbitrarily typed links. Four basic constructs are included in the system: notecards, links, browsers, and fileboxes. Notecards contain an arbitrary amount of information embodied in text, graphics, images, voice, or any other editable or presentable substance. Links are used to represent binary connections or relationships between cards. Browsers are cards that contain editable note-link diagrams showing the structure of some portion of the network. Fileboxes are cards that provide the user with a hierarchical filing structure for organizing collections of cards into topics or categories. The Notecards system was developed for, and runs with, the Xerox LISP environment and the Xerox 1100 workstation. In addition, Notecards can be integrated with other systems running in the LISP environment such as mail systems, databases, and rule-based expert systems. (2 references) (EW)

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NoteCards: A Multimedia Idea Processing Environment

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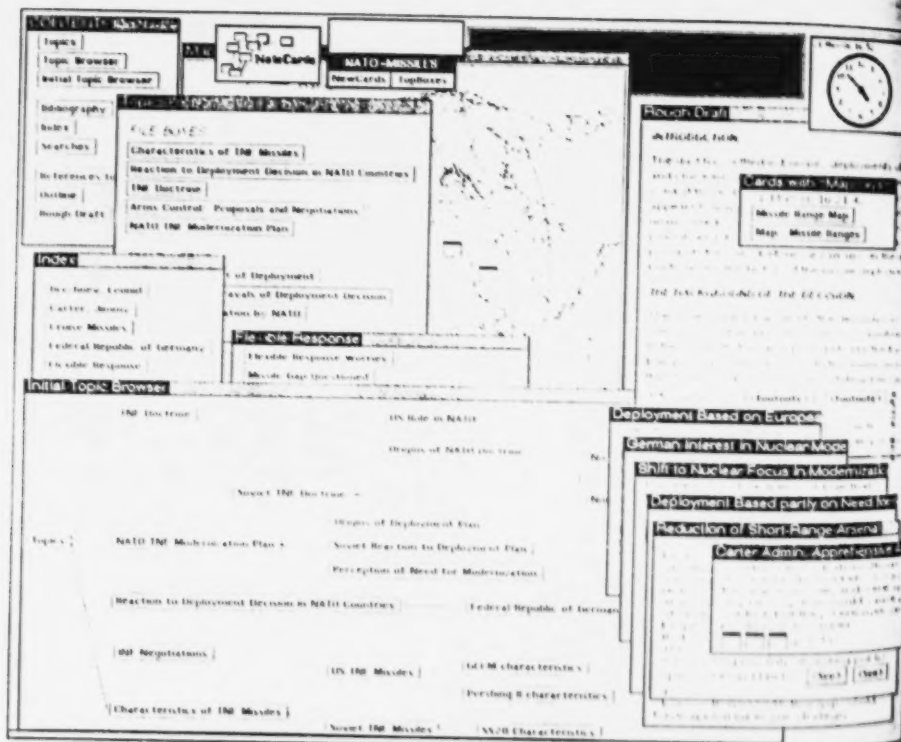
NoteCards is a computer environment designed to help people work with ideas. Its users are authors, researchers, designers, and other intellectual laborers engaged in analyzing information, constructing models, formulating arguments, designing artifacts, and generally processing ideas. NoteCards provides these users with a rich and extensible set of tools that support a variety of specific activities ranging from sketching on the back of an envelope through formally representing knowledge. Together, these tools provide an environment for capturing, representing, interrelating, managing, and communicating ideas. In this environment, users can develop their ideas, transforming informal and unstructured jottings into formal analyses and structured presentations.

NoteCards is a hypermedia system. Its basic framework is a semantic network of electronic notecards connected by arbitrarily typed links. This network serves both as a medium in which the user can represent collections of interconnected ideas, and as a structure for organizing, storing, and retrieving information. NoteCards provides the user with tools for displaying, modifying, manipulating, and navigating through the network. It also includes a set of well-defined methods and protocols for programmatically manipulating the network. These basic components constitute the core for NoteCards' extensible environment for idea processing.

There are four basic constructs in NoteCards: notecards, links, browsers, and fileboxes. Each notecard contains an arbitrary amount of information embodied in text, graphics, images, voice, or any other editable or presentable substance. On the screen, a notecard is usually displayed in its own editor window. Links are used to represent binary connections or relationships between cards. Each link is represented by an "active" link icon located at an anchor point in the link's source card. Clicking in the link icon with the mouse traverses the link; that is, retrieves the destination card of the link and displays it on the screen ready to be read or edited. Browsers are cards that contain editable node-link diagrams showing the structure of some portion of the network. Fileboxes are cards that provide the user with a hierarchical filing structure for organizing collections of cards into topics or categories.

NoteCards was developed and runs within the Xerox LISP environment on the Xerox 1100 series workstation. The system includes a well-documented programmer's interface that provides programmatic access to all of the system's functionality. This interface can be used to tailor the system to particular tasks or users. In addition, NoteCards can be integrated with other systems running in the LISP environment such as mail systems, data bases, and rule-based expert systems.

NoteCards' multimedia characteristics derive from its type mechanism, which allows users to add facilities for handling arbitrary new types of notecards to the system. The basic system handles text, graphics, and images, with the ability to integrate all of these media into a single notecard. Users of NoteCards have created several dozen additional card types, including animation cards, voice cards, video cards, and action cards. Many of these new card types stretch the notion of "displaying" a notecard. The video cards control a videodisc player that plays a designated video segment on a separate screen when the card is displayed. Action cards contain a short program describing an action that is carried out when the card is displayed.



Although it is an experimental system, NoteCards is currently being used for a wide range of applications. The majority of these applications center around the creation, management, and analysis of loosely or irregularly structured information. Examples of such applications include researching and writing complex legal briefs, analyzing the arguments presented in scientific and public policy articles, and managing the general personal and project information for small group research projects. In all of these applications, the use of NoteCards focuses on authoring and structuring a network of notecards, with subsequent access to this network primarily by the original authors.

A significant minority of NoteCards applications focus on the presentation of nonlinear multimedia "documents." For example, NoteCards has been used as the basis for a number of interactive, nonlinear tutorial and reference manuals. More important, NoteCards has been used for the design, development, and delivery of interactive computer-assisted training for copier repair technicians. This application includes interactive video as well as interactive graphics simulations within the NoteCards framework. One important feature of this application is that the same system was used for both course design/development and for course presentation.

Observation of NoteCards in use has shown that much of its power derives from the fact that it presents a uniform, spatial, direct-manipulation interface to a wide variety of different kinds of information represented in a variety of different media. The same access operation (following a link) can bring up a text file to be edited, start a running animation, carry out a data-base search, play a video sequence, or execute an action. All of these "pieces of information" are uniformly represented as notecards and can be integrated into a NoteCards network for access and organizational purposes. Moreover, NoteCards provides the ability to easily view and edit not only these pieces of information, but also the organizational structure into which they are placed.

Observation on NoteCards in use has also shown several limitations inherent in the system. NoteCards (and hypermedia systems in general) rely too exclusively on navigational access to information. A significant improvement in functionality would accrue if navigational access were augmented by search mechanisms that allow query-based access to both the content and structure of the hypermedia network. NoteCards is also limited in its facilities for supporting collaborative work within a single network. It is not uncommon for one user to get lost in the web of information created by another user, since NoteCards makes no effort to enforce a (as yet undiscovered) rhetoric of hypermedia. These and other limitations form the basis of our ongoing research into the next generation of hypermedia systems.

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Frank G. Halasz

Frank Halasz received his Ph.D. in Cognitive Psychology from Stanford University in 1983. His thesis research explored the role of mental models in learning to use complex machines. In 1983, he joined the Intelligent Systems Laboratory at Xerox PARC, where he developed NoteCards (a hypermedia-based idea-processing system) and investigated the use of such systems to support authoring and argumentation. In 1986, he joined the Software Technology Program at the Microelectronics and Computer Technology Corporation (MCC) in Austin, Texas, where he continues his research in human-computer interaction, specifically the design of computer-based tools to support intellectual work. He is currently building the ultimate hypermedia system, and exploring its use by teams of designers in the early, decision-making phases of large software projects.